Common Volcanic Processes at Cascade Volcanoes

Graphic #1 Tephra – volcanic ash

Mount St. Helens volcanic ash brings darkness to Yakima, Washington at noon on May 18, 1980

Explosive eruptions from the volcano's ***vent*** blast fragments of rock high into the air. Large fragments fall to the ground near to the volcano, while small fragments create large ***eruption clouds*** capable of traveling thousands of miles from the volcano. Ash clouds are usually non-toxic but have the capability to disrupt people's lives for long periods. Heavy ashfall can collapse buildings, and even minor ashfall reduces visibility and can damage crops, electronics, and machinery.

Graphic #2 Tephra – volcanic bombs

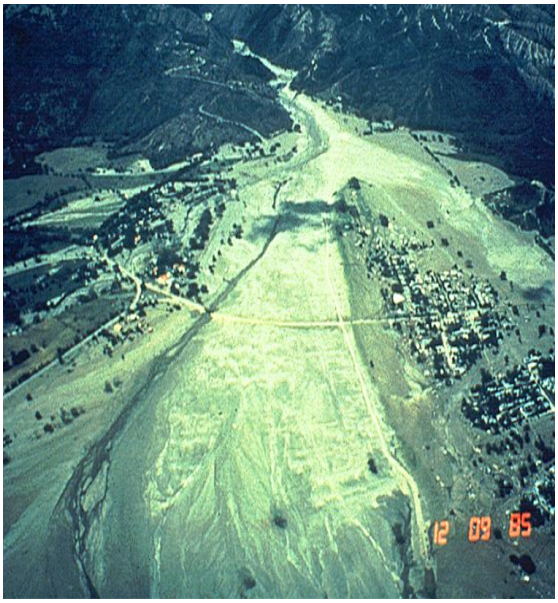
Volcanic bombs are the pieces of tephra that has been twisted or smoothed as it falls on or close to the cone of a volcano. They erupt as flying balls of hot lava and cool quickly on the outside, before they even hit the ground. Volcanic bombs can be as large as a house!

Graphic #3 - Lava flow on Villarica Volcano in Chile

Lava is molten rock that pours or oozes onto the earth's surface. Lava flows stiffen as their outsides cool within minutes but inside remains hot and more fluid, taking days to years to cool. Numerous eruptions of lava between layers of soft volcanic ash created Mount Rainier as it appear today.

Graphic #4 - Pyroclastic flow on Montserrat Volcano in the Caribbean

Pyroclastic flows are avalanches of hot lava fragments and volcanic gases formed by the collapse of ash clouds and lava flows. These flows rush down the mountain at speeds up to a few hundred kilometers per hour. They destroy everything in their path by incineration, asphyxiation, or burial. Nothing will survive in the path of a pyroclastic flow.



Graphic #5 - Lahar deposit at Armero, Colombia.

The word ***lahar*** is an Indonesian term that describes a mixture of rock, mud, and water that rushes down the slopes of a volcano and its river valleys for many kilometers away from the volcano and at speeds of sixty kilometers per hour (forty miles per hour). Lahars and their scaled-down versions, known as ***debris flows***, once witnessed, are never forgotten. The ground shakes and rumbles in a way similar to that of an approaching train. Dust plumes rise into the air above the flow front and small pebbles splash skyward. These flows look and behave like a river of wet flowing concrete and are tan to gray in color.

During volcanic eruptions, hot rocks melt snow and ice and produce large amounts of meltwater that can entrain loose rock and become a lahar. The enormous snow and ice packs on the slopes of Cascade volcanoes are a particular threat. Approximately 4.4 cubic kilometers (one cubic mile) of ice and perennial snow (snow that remains from year to year) covers the slopes of Mount Rainier. That is as much as on all the other Cascade volcanoes combined! An eruption can melt vast fields of snow and ice, which would in turn pick up and carry large quantities of loose rock down stream. Catastrophic landslides or eruptions can trigger lahars.

This photo illustrates the devastation caused by a lahar that was triggered by the November 13, 1985 eruption of the snow and ice capped Nevado del Ruiz volcano in Columbia. This lahar only traveled at an average velocity of twenty miles per hour, so the people in the nearby city of Armero had more than two hours to climb to safety of the higher ground of nearby valley walls. However, they had not been advised on evacuation procedures or warned of the lahar's approach. More than twenty thousand people perished, as the lahar swept away or buried much of the city.

Graphic #6 – Debris flow

Debris flows are smaller versions of a lahar. Scientists and public officials name these destructive events "debris flows" at Mount Rainier when the flows are small and stay within park boundaries. They call flows "lahars" when they travel beyond park boundaries. Debris flows commonly occur during periods of intense rainfall or snowmelt.

Graphic #7 – Landslide

A landslide, or debris avalanche, is a rapid downhill movement of rocky material, snow, and/or ice. Volcano landslides can be small movements of loose debris on the surface of a volcano or massive collapses of the entire summit or sides of a volcano. Steep volcanoes can be especially vulnerable to landslides, since they are partially built of layers of loose volcanic rock fragments, which break free and move downhill. Landslides on volcano slopes are triggered when eruptions, heavy rainfall, or large earthquakes occur.

Graphic #8 – Hydrothermal Alteration Weakened Lava Rock

Some rocks on volcanoes have been altered to soft, slippery clay minerals from circulating hot, acidic ground water, through a process called hydrothermal alteration. Entire portions of a steep slope can be left susceptible to collapse through landslides and lahars. Parts of Mount Rainier are weak and unstable due to hydrothermal alteration. Altered rock is often visible in the vicinity of ***fumaroles***, steam vents on the volcano's surface.

Graphic #9 - Volcanic processes at Cascade Volcanoes

A common sequence of events at stratovolcanoes: During the onset of a volcanic eruption, volcanic gasses in the magma expand and fragment into pieces called tephra. After many of the gases have dispersed in the atmosphere, a more fluid lava pool within the crater rises and flows over the crater lip as a lava flow. The ensuing lava flows commonly break apart on steep volcanic terrain as avalanches of hot rock and gases. These pyroclastic flows melt snow and ice, providing the water for debris flows and lahars (large debris flows). Pyroclastic flows also originate from the collapse of eruption columns, the dark column of ash, steam, and other gases that rise above a volcano as it erupts. Rocks that have been hydrothermally altered by hot acidic groundwater become more susceptible to collapse. Where lava is too viscous to flow it forms a dome-shaped feature commonly called a ***lava dome***.

Photo Credits:

1) Volcanic Ash, *Jack Whitnall, 1980.*
2) Volcanic bomb found at Kilauea Volcano, *Jack Lockwood, US Geological Survey, July 10, 1982.*
3) Lava Flow at Villarica Volcano, *Hugo Moreno, Servecio National de Geologia y Mineria, Chile.*
4) Pyroclastic Flow at Montserrat Volcano, *Willie Scott, US Geological Survey, 1995.*
5) Lahar Armero, Colombia, *Richard Janda, US Geological Survey, 1985.*
6) Debris Flow, *Toni Venzin, Tren, Canton of Grisons, Switzerland.*
7) Landslide at Casita Volcano, *Kevin Scott March 25, 1999.*
8) Hydrothermally-altered rock, *Steve Brantley, US Geological Survey .*